

WHAT IS CLAIMED IS:

1. A semiconductor device comprising:

a barrier layer formed on an insulating or conducting film provided on a semiconductor substrate; and

an electrode or an interconnect made from a conducting film formed on said barrier layer,

wherein an interatomic distance on an upper plane of said barrier layer and an interatomic distance on a lower plane of said conducting film are nearly equal to each other.

2. The semiconductor device of Claim 1,

wherein said barrier layer has a tetragonal crystal structure and the upper plane of said barrier layer is oriented to the (001) plane, and

said conducting film has a face-centered cubic crystal structure and the lower plane of said conducting film is oriented to the (111) plane.

3. A semiconductor device comprising:

a barrier layer formed on an insulating or conducting film provided on a semiconductor substrate; and

an electrode or an interconnect made from a conducting film formed on said barrier layer,

wherein said barrier layer includes a tantalum film having a  $\beta$ -crystal structure.

4. The semiconductor device of Claim 3,

wherein said barrier layer is made from a multi-layer

film composed of a lower first barrier layer and an upper second barrier layer, and

said first barrier layer is made from a nitride film and said second barrier layer is made from a tantalum film  
5 having a  $\beta$ -crystal structure.

5. The semiconductor device of Claim 4,

wherein said first barrier layer is made from a tantalum nitride film, and

said conducting film is a copper film.

10 6. The semiconductor device of Claim 5,  
wherein said copper film is oriented to the (111) plane.

7. The semiconductor device of Claim 5,

wherein a value of (a number of nitrogen atoms)/(a number of tantalum atoms) of said tantalum nitride film is  
15 0.4 or less.

8. The semiconductor device of Claim 4,

wherein said insulating or conducting film is an insulating film including a fluorine component.

9. The semiconductor device of Claim 3,

20 wherein said insulating or conducting film is an insulating film,

said barrier layer is formed on a bottom and walls of a recess formed in said insulating film, and

said conducting film is a plug or a buried interconnect  
25 filled in said recess on said barrier layer.

10. A method of fabricating a semiconductor device comprising the steps of:

forming a barrier layer on an insulating or conducting film provided on a semiconductor substrate; and

forming an electrode or an interconnect made from a conducting film on said barrier layer,

wherein an interatomic distance on an upper plane of said barrier layer and an interatomic distance on a lower plane of said conducting film are nearly equal to each other.

11. The method of fabricating a semiconductor device of Claim 10,

wherein said barrier layer has a tetragonal crystal structure and the upper plane of said barrier layer is oriented to the (001) plane, and

said conducting film has a face-centered cubic crystal structure and the lower plane of said conducting film is oriented to the (111) plane.

12. A method for fabricating a semiconductor device comprising the steps of:

forming a barrier layer on an insulating or conducting film provided on a semiconductor substrate; and

forming an electrode or an interconnect made from a conducting film on said barrier layer,

wherein said barrier layer includes a tantalum film having a  $\beta$ -crystal structure.

13. The method for fabricating a semiconductor device  
of Claim 12,

wherein said barrier layer is made from a multi-layer  
film composed of a lower first barrier layer and an upper  
5 second barrier layer, and

said first barrier layer is made from a nitride film  
and said second barrier layer is made from a tantalum film  
having a  $\beta$ -crystal structure.

14. The method for fabricating a semiconductor device  
10 of Claim 13,

wherein said first barrier layer is made from a  
tantalum nitride film, and

said conducting film is a copper film.

15. The method for fabricating a semiconductor device  
15 of Claim 14,

wherein said copper film is oriented to the (111) plane.

16. The method for fabricating a semiconductor device  
of Claim 14,

wherein a value of (a number of nitrogen atoms)/(a  
20 number of tantalum atoms) of said tantalum nitride film is  
0.4 or less.

17. The method for fabricating a semiconductor device  
of Claim 13,

wherein said insulating or conducting film is an  
25 insulating film including a fluorine component.

18. The method for fabricating a semiconductor device  
of Claim 12,

wherein said insulating or conducting film is an  
insulating film,

5       said barrier layer is formed on a bottom and walls of a  
recess formed in said insulating film, and

      said conducting film is a plug or a buried interconnect  
filled in said recess on said barrier layer.

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